Effect of *in ovo* injection of vitamins on the chick weight and post-hatch growth performance in broiler chickens

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An experiment was conducted to study the effect *in ovo* injection of vitamins on the embryonic and post-hatch growth performance. Fertile eggs (n=350) were weighed, distributed in to 7 groups and set in force-draft incubator. On 14th ED five groups were injected with 100 IU Vitamin-A, 0.5 IU Vitamin-E, 50 mg Vitamin-C, 100 µg Vitamin B1 and 100 µg Vitamin B6 dissolved in 0.5 ml of sterile water. Rest two groups were used as sham control (0.5 ml sterile water) and un-injected control. The chicks hatched from the above experiment were housed in battery brooders and provided standard diet and other managemental practices. Hatchability on fertile egg set basis in the Vitamin B_6 group was apparently higher (81.5%) than sham control (72%) and un-injected control (80%). Vitamin E and Vitamin B_1 injected groups had more number of deaths just before piping of chicks. Chick weight to egg weight ratio (%) was higher (P<0.01) in chicks injected with Vitamin-A (72.66%), Vitamin-C (72.26%) than un-injected control (70.94%). Body weight was more at 14 and 28 d of age (P<0.01) in Vitamin-E and B_1 injected groups than un-injected control. However, FCR did not differ among treatment groups. It may be concluded from the above experiment that vitamin A and vitamin C may influence the embryonic development, whereas, vitamin-E and vitamin B1 may be required for early post-hatch growth.

Keywords: In ovo injection; vitamins; hatchability; growth; broiler chickens

Introduction

Vitamin E is the major fat-soluble antioxidant, which breaks the chain reaction of lipid peroxidation. The antioxidant system of the brain is of great importance because of the development of nutritional encephalomalacia, which occurs in young chicks as a result of vitamin E deficiency (Dror and Bartov, 1982). Vitamin C (ascorbic acid) has been demonstrated to improve immunoresponsiveness and increase disease resistance in poultry by optimizing the immune system (Pardue et al., 1985; Rund, 1989). Ascorbic acid has also been shown to have a sparing effect on vitamin E by acting as a redox system reducing tocopheroxyl radicals back to their reduced state tocopherol (Wilson, 1983).

Thiamin (Vitamin B_1) is a co factor for several enzymes catalyzing decarboxylation and trns-skeletolation type reactions. Deficiency of thiamin in egg causes high mortality of embryo just prior to hatching and chicks that hatch express polyneuritis (Charles, et al.1972). Deficiency of vitamin B6 (pyridoxine) lead to early embryonic death (Landauer, 1967) and decreased IgM and IgG response to antibody challenge (Blalock et al. 1984).

Owing to the importance of the hatchability and early post-hatch growth on the market size of the broilers a study was undertaken to examine the effect of *in ovo* injection of vitamins the hatchability parameters and early post-hatch growth in broiler chickens.

Materials and methods

Fertile eggs (n= 350), from the broiler breeders maintained on the adequate nutritional plane were collected, weighed and distributed into seven groups of 50 eggs each. The first five groups were injected with 100 IU Vitamin-A, 0.5 IU Vitamin-E, 50 mg Vitamin-C, 100 µg Vitamin B1 and 100 µg Vitamin B6, respectively dissolved in 0.5 ml of sterile water on 14th day of incubation using 25 mm needle as per the method standardized by Bhanja *et al.* (2004a). Rest two groups were used as sham control (0.5 ml sterile water/egg) and un-injected control. Sterile water injection was included as sham control, primarily to rule out a possible negative response caused by the stress of injection and handling. The injections were carried out under laminar flow system, where the temperature of the chamber was maintained at 35 ^{0} C. The *in ovo* injection of each treatment was completed within 20 minutes of taking out from the incubator. The injections were done through a pinhole made at the broad end of the egg. Immediately after the injection, the site was sealed with sterile paraffin and eggs were returned to the incubator. On the 19th d the eggs were shifted to the hatcher and kept in the respective pedigree hatching boxes. On the day of hatch chicks were weighed, wing banded and transferred to the battery brooders for growth performance study. The chick weight to egg weight (pre-incubated) ratio and hatching percentages were compared among treatment groups to see the effect of vitamins injection.

Bird housing and management:

The chicks hatched from the respective treatment group were distributed in 4 tier battery brooder cages having thermostatic control of temperature with provisions for separate feed, water and droppings trays. They were provided with broiler starter (23 % CP and 3000 kcal ME /kg diet) up to 28 days of age.

Data analysis:

Data were analyzed as a randomized complete block design using one-way ANOVA. Individual bird's weight was the unit for analysis of body weight data, whereas battery brooder cages were the experimental unit for feed intake and FCR (Snedecor and Cochran, 1980). Differences among the treatments were determined with Duncan's multiple range test (Duncan, 1955). The least square analysis of variance technique as per Harvey (1975) was used for analyses of those egg weights, chick weights and their ratio data having unequal number of observations.

Results and discussion

Hatchability and chick weight

In ovo injection of vitamins did not exert any deleterious affect on percent hatchability, only in Vitamin E and Vitamin B_1 injected group there was apparently lower hatchability and more number of embryonic death just before piping (*Table 1*). In our earlier experiment, *in ovo* injection of graded level of vitamin E (0.25 IU to 0.75 IU), hatchability was around 70% in 0.25 IU Vitamin E group and 52.9-56.0%. in 0.50-0.75 IU Vitamin E groups. In the present study also hatchability in 0.50 IU vitamin injected group was 54.7%. It implies *in ovo* supplementation of ≥ 0.50 IU Vitamin E is detrimental to embryo. It is to be pointed out that a normal size egg (60g) contains around 0.50 IU Vitamin E. Hatchability in the Vitamin B_6 group was apparently higher (81.5%) than sham control (72%) and un-injected control (80%). Vitamin B_6 alleviates early embryonic death (Landauer, 1967), which was evident from our study as the hatchability in Vitamin B_6 group was apparently higher than un-injected control group. Uni and Ferket (2004) reported that *in ovo* feeding on 18th d of incubation had a negligible effect on hatchability (87% in control and 86% among *in ovo*-fed broiler embryos). In our earlier experiment (Bhanja *et al*., 2004b) also *in ovo* injection of amino acids at 14th day of embryonic age had around 81.5% hatchability, which is comparable to hatchability in present study in

Vitamin B_6 and un-injected control. Though there was no difference (P>0.05) chick weight and egg weight, but their ratio was higher (P<0.01) in chicks injected with Vitamin-A (72.66%), Vitamin-C (72.26%) than un-injected control (70.94%). Vitamin C is devoid in egg. *In ovo* supplementation of Vitamin C would have helped in more collagen synthesis in developing embryo, besides acting as a source of energy. Bhanja *et al.* (2004 b) had also reported that *in ovo* AA injected on 14th d had 2.1% higher chick weight as compared to un-injected control.

Table 1 Effect of *in ovo* vitamins injection on the hatchability and chick weight to egg weight ratio in broiler chickens

	Percent hatchability	Died after injection	Death before piping	Egg weight (g)	Chick weight (g)	Chick wt. to egg wt ratio
Vitamin A 100IU/egg	73.2	12.5	14.3	61.39	44.63	72.66^{c}
Vitamin E 0.5IU/egg	54.7	13.2	32.1	63.33	45.08	71.20^{ab}
Vitamin C-50mg/egg	64.9	19.3	15.8	61.78	44.67	72.26^{bc}
Vitamin B1 -100 µg/egg	60.4	7.5	32.1	62.77	44.34	70.64^{a}
Vitamin B6 -100 µg /egg	81.5	1.9	16.7	62.88	44.33	70.45^{a}
Sham control	72.2	13.9	13.9	62.89	45.03	71.57^{abc}
Un-injected control	80.0	0.0	20.0	62.34	44.24	70.94^{a}
Pooled SEm	NA	NA	NA	0.286	0.236	0.151
Level of significance	NA	NA	NA	NS	NS	P<0.01

NA- Not applicable as single hatch was taken
NS- Non-significant at P>0.05
^{abc}Means not sharing a common superscript in column vary significantly (P<0.05)

Post-hatch growth performance

Though there was no significant difference in the body weight among vitamin injected groups, sham control and un-injected birds at 14 days of age, apparently all the vitamin injected groups had 11.4 to 22.2 g higher body weigh. However, such differences reached to significance level at 28days of age. Vitamin-E and Vitamin B_1 injected groups had significantly higher body weight (P<0.01) at 28 days of age than un-injected control *(Table 2)*. Ferket and Uni (2004) reported that *in ovo* feeding treatment increased body size by 3% over controls during 0-7 days of age (P<0.05). In our earlier experiment (Bhanja et al, 2006) at lower dose of vitamin E (0.25-0.50 IU) 58.5 -81.3 g higher (P<0.05) body weight was recorded at 28 days of age than un-injected control group. Gore and Qureshi (1997) suggested that *in ovo* injection of vitamin E three days prior to hatch may improve post-hatch poult and broiler quality.

Though statistically non significant difference was observed in FCR among vitamin injected groups, but birds injected with vitamin C and Vitamin B_6 had apparently better FCR un-injected control group. However, in our earlier experiment (Bhanja et al., 2006) the Vitamin E injected birds had significantly better (P<0.05) FCR than un-injected control birds during 0-14 days of age.

It may be concluded from the above experiment that vitamin A and vitamin C may influence the embryonic development, whereas, vitamin-E and vitamin B1 may be required for early post-hatch growth.

Table 2 Effect of *in ovo* vitamins injection on the growth performance of broiler chickens

		Body weight (g)			FCR	
Treatments	**Day old**	**14th d**	**28th d**	**0-14d**	**15-28 d**	**0-28 d**
Vitamin A	44.6	187.9	476.0[ab]	1.79	2.30	2.13
Vitamin E	44.9	191.0	534.9[bc]	1.93	2.28	2.18
Vitamin C-	44.1	197.3	486.4[ab]	1.66	2.19	2.00
Vitamin B1 -100	44.1	196.9	553.2[c]	1.80	2.27	2.13
Vitamin B6 -100	44.5	182.3	465.6[a]	1.70	2.19	2.03
Sham control	44.8	186.5	478.5[ab]	1.72	2.17	2.02
Un-injected	44.0	174.1	428.3[a]	1.72	2.32	2.11
Pooled SEm	0.25	2.84	10.01	0.030	0.023	0.022
Level of	NS	NS	P<0.01	NS	NS	NS

NS- Non-significant at P>0.05, [abc]Means not sharing a common superscript in column vary significantly (P<0.05)

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